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Work Experience

Quantitative Analyst (Nov 2019 – Present) Financial Markets, Standard Chartered Bank, Singapore

- Maintain and improve in-house FX pricing libraries; Support trading desk; Develop FX and hybrid pricing models (stochastic local volatility models, local volatility models with stochastic rates, in C++)

Vice President (Oct 2016 – Nov 2019) Model Validation Group, Nomura Singapore Limited

- Validate FX and hybrid pricing models. Implement benchmark models (in C++): PDE based stochastic local volatility models, local volatility model with stochastic rates, hybrid model with skew-aware rates and FX. Liaison with desks, quants and finance on model development, trade approvals and model reserves

Vice President (Jan 2015 – Oct 2016) Risk Analytics Division, United Overseas Bank, Singapore

- Validate pricing models and implement benchmark models for rates, FX and equity (in Python): CSA curve building; PDE and AMC based Hull-White one factor model in multi-curve framework for Bermudan swaptions/cancellable range accruals/target redemption notes; CMS valuation by static replication of swaptions; PDE and MC based local volatility model for FX TARF; CVA model with calibration, joint simulation of rates/FX/equities, valuation; PDE based local volatility model for equity barrier options with discrete dividends

Vice President (Jan 2012 – Jan 2015) Markets & International Banking, Royal Bank of Scotland Plc, Singapore

- Review risk models and methodologies. Perform risk attribution and P&L explanation, historical simulation, VaR impact analysis, stress testing and backtesting. Identify gaps in current models and recommend mitigating solutions. Develop ad-hoc analysis tools for PCA based data imputation, rate scaling in historical simulation, advanced VaR backtesting based on diagnostic statistical hypothesis tests

Manager (Sept 2010 – Jan 2012) Financial Risk Management, KPMG Advisory (China) Ltd., Beijing, China

- Valuate financial derivatives for Lehman Brothers liquidation, covering rates, FX and structured equity products. Manage consulting projects for local banks: market risk project (regulatory policy, risk attribution and risk factors, VaR, historical simulation, back testing and stress testing) and economic capital project (capital planning and performance measure, credit risk measurement, risk aggregation)

Analyst (Jan 2010 - Sept 2010) China Chengxin Credit Management Co. Ltd., Beijing, China

- Develop PV and risk analytics for fixed income instruments (in Java)

Research Analyst (Internship) (June 2009 - Dec 2009) AQR Capital Management (Hedge Fund), Greenwich, Connecticut, USA

- Build quantitative tools for in-house investment strategy research and portfolio management relating to equities and equity-linked products (in Python, Java and SQL)

Research Assistant (2002 - 2008) Center for the Simulation of Accidental Fires and Explosions, University of Utah, Salt Lake City, Utah, USA

- Participate in a large multi-disciplinary research project sponsored by the US Department of Energy that performs cutting-edge research on computer simulations of complex physical and chemical reactions of fires and explosions. Develop and implement combustion models for Uintah (a computational framework of solid and fluid mechanics). These models incorporate simplified and/or complex schemes of gas phase and condensed phase reaction kinetics for various simulation scenarios (e.g. steady or unsteady, mesoscopic or macroscopic, exploding container or flame spreading) (in Linux/C++)

Education

M.S. in Financial Mathematics (Aug 2008 - Dec 2009) Rutgers University, New Brunswick, New Jersey, USA

- stochastic calculus, mathematical statistics, computational finance, PDE/MC, time series analysis, portfolio management, credit derivatives, volatility surface, rates models

Ph.D. in Physical Chemistry (Jan 2001 - May 2007) University of Utah, Salt Lake City, Utah, USA

- Dissertation: Use of simplified chemical kinetics in simulation of combustion and explosions

M.S. in Computational Engineering and Science (Jan 2004 - Dec 2005) University of Utah, Salt Lake City, Utah, USA

- scientific computing, applied math, numerical linear algebra, math modeling, numerical optimization, computer algorithms, scientific visualization, advanced computer graphics

B.S. in Chemistry (Sept 1996 - July 2000) Nankai University, Tianjin, China

Computer Skills

- Programming Languages: C/C++, Python, Java, Haskell, MATLAB, Excel/VBA, SQL
- Coursework in Computer Science: 1) OOP and software engineering; 2) advanced data structures and algorithms; 3) advanced computer systems; 4) operating systems; 5) advanced computer graphics (OpenGL); 6) scientific visualization
- Windows and Linux (Visual Studio, VS Code, SQL, shell scripting, git)

Publications

- Book Chapter 3 in “*Market, Liquidity and Asset Liability Management Risk Manager Handbook*” published by PRMIA in 2015

Selected Projects (please refer to <https://modelmania.github.io/main/>)

- **Generalized Local Volatility Models**

Develop generalized local volatility model, which extends classic Dupire local volatility model by incorporating stochastic domestic and foreign rates. Hull-White one factor model is assumed for both rates processes. Numerically, ADI operator splitting method is used to solve 3D forward PDE in calibration and 3D backward PDE in valuation. This model has been further extended into a multi-state generalized local volatility model, which is essentially a stochastic local volatility model with stochastic rates.

- **Stochastic Local Volatility Models**

Build implied volatility surface given ATM and delta conventions. Develop stochastic local volatility models, which are a hybrid of classic Dupire local volatility model and pure stochastic volatility model mixed organically by a term structure of weighting coefficients. Stochastic volatility can be modelled either by a continuous exponential Ornstein Uhlenbeck process or by its equivalent discrete Markov chain process. Model calibration is done through forward induction by solving 2D forward PDE using ADI operator splitting method (if assuming the continuous OU process), or by solving and mixing multiple layers of 1D forward PDEs (if assuming the discrete Markov chain). Valuation is achieved by solving backward PDEs or by Monte Carlo simulations

- **Hull-White One Factor Model in Multi-Curve Framework**

Implement PDE and AMC based Hull-White one factor model in a multi-curve framework. The model is calibrated to caplets or co-terminal swaptions. Finite difference method and least square Monte Carlo simulation are employed in valuation of rates products, e.g. Bermudan swaptions, cancellable range accruals and target redemption notes

- **Introduction to Interest Rate Models**

Martingale pricing theory, change of numeraire, convexity adjustment, CMS static replication by swaptions, HJM model, affine term structure, Hull-White model, multi-factor Gaussian model, Jarrow-Yildirim 3-factor model, Libor market model, finite difference and ADI operator splitting, multi-dimensional Sobol sequence and Quasi Monte Carlo, least square Monte Carlo

- **Parameterized Local Volatility Model**

Local volatility surface constructed as piecewise linear in log-moneyness and piecewise constant in time. Calibration by forward PDE and valuation by backward PDE

- **Heston's Stochastic Volatility Model**

Market price of spot and volatility risk, Feller's condition, Kolmogorov backward and forward PDE, distribution of spot and volatility process, option pricing by Fourier transform, characteristic function, time dependent Heston model, Monte Carlo simulation by quadratic exponential scheme, pricing by PDE and finite element method

- **OIS Discounting and Multiple Curve Construction**

Monotone Hermite cubic spline interpolation, OIS discounting curve and LIBOR projection curve bootstrapping, CSA discounting curve bootstrapping with consistent tenor basis spread and cross currency basis spread, taking into account the spot/payment lag, stub period, day count conventions, day rolling conventions and trading calendars